Final Exam, 12/11 10:00- 11:50

• Logic.
  – Operators (especially implication).
  – Predicates and quantifiers.
  – Propositional equivalence.

• Methods of proof.
  – Direct and indirect proofs.
  – Proof by contradiction.

• Sets and functions.
  – Notation in set theory, cardinality of sets, power set.
  – Operations on sets, generalized unions and intersections.
  – Functions: injective, surjective, bijective.
  – Ceiling and floor functions.

• Sequences and summations.
  – Arithmetic and geometric progressions.

• Algorithms.
  – Searching algorithms: linear search, binary search.
  – Sorting algorithms: bubble sort.
  – Complexity of algorithms.

• Asymptotic notation.
  – Showing that \( f(x) = O(g(x)) \) using \( C \) and \( k \).
  – Showing that \( f(x) \) is not \( O(g(x)) \).
  – Properties of \( O \)-notation.

• Number theory.
  – Division, prime numbers, modulo operation, and modulo relation.
– Euclidean algorithm, correctness and the Lame’s Theorem.
– Algorithms for change of basis.

● **Mathematical induction.**
– Identities, inequalities, division type statements, statements about Fibonacci numbers.

● **Counting.**
– The sum and the product rules. Permutations and combinations, basic inclusion-exclusion principle.
– The Pigeonhole Principle (statement and basic applications).
– Binomial Theorem.

● **Advanced Counting.**
– Modeling with recurrence relations.
– Solving linear recurrence relations.
– Divide-and-conquer recurrence relations.